INTRODUCTION TO PHOTOVOLTAIC SYSTEMS

About the Workshop

As photovoltaics (PV) continue to grow in popularity, an increasing number of contractors and specialists have incorporated PV into their business plans. If you are considering introducing photovoltaics into your professional portfolio, this workshop will give you the basic concepts of California grid-connected systems to compete in this expanding market. This training provides an overview of solar electric generation, system design and installation, and basic code compliance.

RENEWABLE ENERGY PROGRAM
CALIFORNIA ENERGY COMMISSION

KEMA

Workshop Content

Day 1

Introductions

Typical configurations of grid-tied systems

Photovoltaics equipment

-Lunch Break-

Factors affecting PV production

Quantifying PV production

System sizing

Day 2

System design examples: typical residential and commercial systems

-Lunch Break-

Code compliance for PV systems

[Please find our detailed agenda attached]

Who Should Attend?
Solar installers, electricians, building contractors, plan checkers, inspectors, and engineers.

Why You Should Attend?
To learn the basics of photovoltaics system design and installation

When?
November 7-8, 2005
9 am – 5 pm (lunch not included)
Registration opens at 8:30 am
**Other dates and locations TBA*

Location?
Chico Learning Center, Room #119
University of Phoenix
500 Orient Street, Chico, CA

Cost? $30

RSVP by November 3
Space is limited!

Contact? Nellie Tong
(510) 891-0446
nellie.tong@kema.com

Doug Livingston, Trainer

Doug Livingston *has over 10 years of technical and training experience with customer-sited renewable energy systems, both on and off-grid. He has trained thousands of people on photovoltaic system selection, design and installation. At* Real Good Trading Corporation*, he was in charge of selecting equipment, training technical staff and doing feasibility studies and troubleshooting on all kinds of customer-sited renewable energy systems. At KEMA, Mr. Livingston provides technical support to the California Energy Commission related to the Emerging Account in the Renewable Energy Program.*

Contact Nellie Tong by November 3 at 510-891-0446 or nellie.tong@kema.com to register!

Registration Form

Course Title: Introduction to Photovoltaic (PV) Systems
Date: November 7-8, 2005

Please send a $30 check payable to KEMA Inc to Nellie Tong at 492 Ninth Street, Suite 220, Oakland, CA 94607.

Name:

Company:

Phone number:

Email:

How have you been involved with PV? (eg. installer, educator, retailer, sales...)

Approximately how many years of PV experience do you have?

Approximately how many systems installed have you installed?

Approximately how many people/customers do you talk to per year about PV?

How did you hear about this workshop?

Please rate your level of understanding for the following topics, with 1 being very little to 5 being expert knowledge:

	Very little.....Expert Knowledge				
	1	2	3	4	5
Configurations of grid-tied systems	☐	☐	☐	☐	☐
Photovoltaic equipment	☐	☐	☐	☐	☐
Factors affecting PV production	☐	☐	☐	☐	☐
Quantifying PV production	☐	☐	☐	☐	☐
System sizing	☐	☐	☐	☐	☐
System design	☐	☐	☐	☐	☐
CA Rebate program and net metering law	☐	☐	☐	☐	☐
Code compliance	☐	☐	☐	☐	☐
Array grounding	☐	☐	☐	☐	☐
Batteries systems	☐	☐	☐	☐	☐

Please submit to nellie.tong@us.kema.com or fax 510 891 0440.
A confirmation will be sent to you once payment is received.

Thank you for registering with us. Please contact Nellie Tong at 510 891 0446 or nellie.tong@us.kema.com if you have any questions.

Introduction to Photovoltaic Systems
Detailed Agenda

Day One (November 7, 2005 @ 9am)

1. Introduction
2. Typical Configurations of Grid-Tied PV Systems
   - 2.1 Battery (Low Voltage DC)
   - 2.2 Non Battery (High and Low Voltage DC)
   - 2.3 Generator Back Up

-Break-

3. Photovoltaic Types
4. Photovoltaic Mounting Options
5. Photovoltaic Orientation
6. Inverter Types
7. Charge Controllers
8. Batteries
9. Meters

~Lunch Break~

10. Factors Affecting PV Production
    - 10.1 PV Array Size
    - 10.2 Inverter Size, Type and Efficiency
    - 10.3 Inverter Temperature
    - 10.4 Solar Resource (Insolation)
    - 10.5 PV Orientation (and Time of Use Implications)
    - 10.6 PV Inclination (and Seasonal Variations)
    - 10.7 PV Temperature (and PV Types and Mounting Types)
    - 10.8 Hard Shadows (and PV Types)
    - 10.9 PV Soiling
    - 10.10 Wire Sizing and Length, Electrical Connection Quality and Fusing
    - 10.11 PV Tolerance and Mismatch
    - 10.12 Power Outages

-Break-

11. Quantifying PV Production
12. System Sizing
    - 12.1 Electric Rate Structures
    - 12.2 Net Metering Law
    - 12.3 Current Rebate and Tax Credit Implications
    - 12.4 Budget

Day Two (November 8, 2005 @ 9am)

1. System Design Examples
   1.1 Typical Residential Low Voltage, Non Battery System
   1.2 Typical Residential High Voltage, Non Battery System
   1.3 Typical Residential Battery Based System
   1.4 Typical Commercial System

~Lunch Break~

Introduction to Code Compliance for PV systems

PV Designer/Installers, electricians are encouraged to attend

1. Code Implications for PV Circuit: Wire Size and Insulation, Circuit Disconnects, and Over Current and Ground Fault Protection
   1.1 PV Ratings
   1.2 PV Conditions
   1.3 Array Configuration

2. Proper Array Grounding

-Break-

3. Inverter Listings for Utility Interconnection
4. Batteries and Battery Enclosures
5. Battery Over Current Protection
6. Charge Controller Ratings and Over Current Protection
7. Utility (not Code) Lock Out System Disconnect
8. Back Fed Breaker Panel
8. Back Up Generator Interface and Transfer Switch

Directions to the University of Phoenix, Chico Learning Center

(The front of the building is adjacent to the parking lot and faces Orient Street)

CAMPUS ADDRESS: 500 Orient Street, Suite 100, Chico, CA 95928
Phone Number: 1-800-266-2107

DIRECTIONS FROM 99 SOUTH:

Take Highway 99 North to Chico
Exit: Highway 32-Chester/Orland

At the bottom of the off-ramp cross over the two lanes of traffic and
TURN LEFT on to Highway 32/8th Street
Follow 8th Street. You will pass two stop lights Cypress and Pine Streets

TURN RIGHT on Orient Street (2 blocks past Pine Street)
Continue on Orient Street to 6th Street

TURN LEFT on to 6th Street and then make an immediate right into the parking lot.
Enter the building thru the left-hand double doors—Suite 100

DIRECTIONS FROM SACRAMENTO via HWY 99/HWY 70

Take Highway 99 North to Highway 99/70 Junction
Merge RIGHT on to Highway 70 toward Marysville
Follow the signs for Marysville/Chico

TURN RIGHT on to Hwy 20 (Carl's Junior Restaurant).
Pass by the Marysville Park with pond
TURN LEFT on to "B" Street/Highway 70

Follow the signs for Oroville/Chico
Continue on Highway 70, you will pass Oroville
TURN LEFT on to Highway 149 (11 miles approx. to Hwy 99 North)
Merge RIGHT on to Highway 99 North to Chico

CHICO EXIT: Highway 32-Chester/Orland

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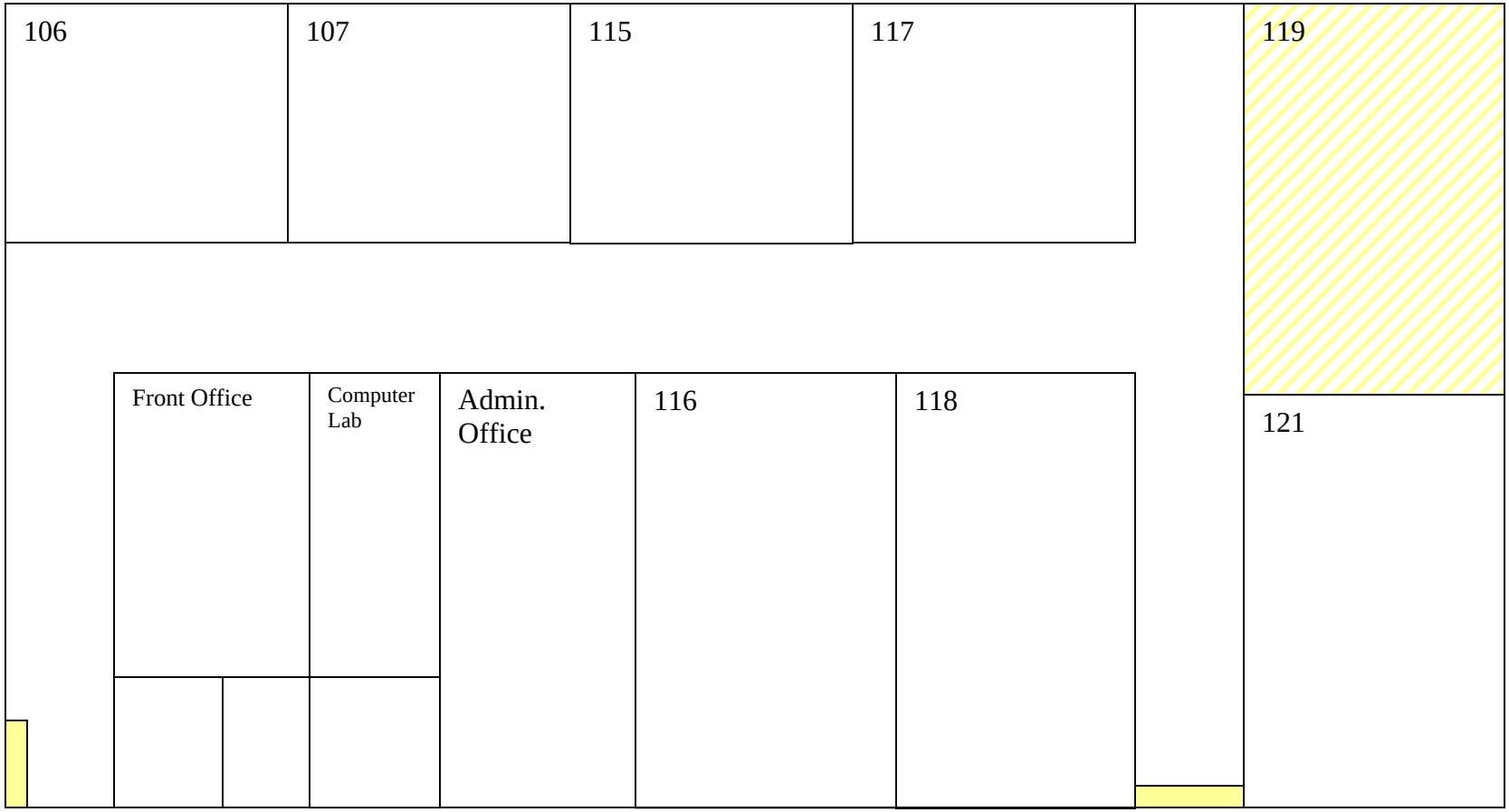
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